APPROVED FOR PUBLIC RELEASE
DISTRIBUTION UNLIMITED

REPORT NO. 88-R-06
AFPEA PROJECT NO. 87-P-130

Larry M. Nugent

Mechanical Engineer

AUTOVON 787-3734

Commercial (513) 257-3734

PERFORMANCE ORIENTED PACKAGING TESTING OF CNU-445/E AND CNU-447/E ALUMINUM MAVERICK MISSILE CONTAINER

HQ AFLC/DSTZ
AIR FORCE PACKAGING EVALUATION ACTIVITY
Wright-Patterson AFB OH 45433-5999

July 1989

ABSTRACT

Aeronautical Systems Division, ASD/SDML, requested assistance from the Air Force Packaging Evaluation Activity (AFPEA) to conduct certification and qualification testing on two new aluminum Maverick missile containers, the CNU-445/E and the CNU-447/E (see AFPEA Test Report 88-R-01). Part of the certification testing was the Performance Oriented Packaging (POP) testing on the container design.

The CNU-445/E and CNU-447/E containers were designed and fabricated by AD/YNP, Eglin AFB, FL 32542-5000. The containers are environmentally sealed with a humidity indicator, desiccant port, and a pressure relief valve. Both containers are designed to protect one AGM-65A/B/C/D/E/F/G all-up-round Maverick missile during world-wide shipment, storage, and handling. The containers will also be used for one missile without the guidance unit and for one missile without the guidance unit and the hydraulic actuation system. The CNU-447/E is the Navy version and differs from the CNU-445/E only in some external Navy-specific handling features.

The test plan used for the container was derived from United Nations (UN) Standard (Ref. ICAD 4.3), UN "Transport of Dangerous Goods", and DOD Hazardous Materials Packaging Test Plan.

Results of the tests conducted on one CNU-447/E container were acceptable. The containers did successfully pass the POP tests, as prescribed by the UN test criteria.

PREPARED BY:

Larry M Nugent

LARRY M. NUGENT
Mechanical Engineer
AFPEA

PUBLICATION DATE:

25 JUL 1989

REVIEWED BY:

Ted Hinds

TED HINDS
Ch, Design Branch
AFPEA

APPROVED BY:

Charlie P. Edmonson

CHARLIE P. EDMONSON
Chief, AF Packaging
Evaluation Activity

TABLE OF CONTENTS

INTRODUCTION

BACKGROUND: Aeronautical Systems Division, ASD/SDML, requested assistance from the Air Force Packaging Evaluation Activity (AFPEA) to conduct certification and qualification testing on two new aluminum Maverick missile containers, the CNU-445/E and the CNU-447/E (see AFPEA Test Report 88-R-01). Part of the certification testing was the Performance Oriented Packaging (POP) testing on the container design. The containers were designed and fabricated by AD/YNP, Eglin AFB, FL 32542-5000.

PURPOSE: The purpose of this project was to determine whether the CNU-445/E and CNU-447/E container design could pass the two required POP tests. The container is designed to provide safe shipment, storage, and handling of one AGM-65A/B/C/D/E/F/G all-up-round (AUR) Maverick missile. The container will also be used for shipment, storage, and handling of the missile less the guidance unit (GU) and the missile less both the GU and the hydraulic actuation system (HAS). The United Nations (UN) hazard code for the missile is class 1.1F. The packing code is Group II, with the packing method of E146.

TEST SPECIMEN

One prototype CNU-447/E container was sent from AD/YNP. The sides and ends were labelled as shown in figure 1.

Design: The CNU-445/E and the CNU-447/E are controlled-breathing containers with a pressure relief valve, a humidity indicator, and a desiccant port. Each container is designed to limit the transmission of shocks to the missile to 30 Gs when subjected to the conditions in ASD/SDML Specification CON 320. Fourteen wide-handle latches are designed to allow quick access to the container contents without the use of tools. The missile is attached to the cradle by a forward bracket and an aft strap (see figure 2). The bracket fits over the forward part of the missile and also pins into the missile itself. This bracket is attached to the cradle by two quick release pins. The strap fits between the two sets of fins on the aft end of the AGM-65 missile.

Construction: The container consists of aluminum extrusions for the exterior walls, the skids, and the missile cradle. Sheet aluminum is used for the top and bottom. Rubber pads between the missile and the cradle prevent scratching or scarring of the missile body. Four pound density polyethylene foam provides cushioning between the cradle and the floor and between the missile and the cover of the container. A silicone gasket provides a seal between the container base and the container cover.

TEST OUTLINE AND TEST EQUIPMENT

TEST PLAN: Tests were conducted in accordance with table I. Test methods and procedures used were as outlined in UN Standard (Ref. ICAD 4.3), UN "Transport of Dangerous Goods", and DOD Hazardous Materials Packaging Test Plan.

TEST CONTAINERS: The tests in this report were performed on a prototype CNU-447/E container (see figure 3). Only one container was used for testing since the tests were severe and it would be too costly to provide a new container for each drop.

TEST LOADS: All tests were conducted using the heaviest missile the container was designed to hold. The test load was an inert missile weighing 675 pounds (see figure 2). A container base loaded to 1191 pounds was also used for test number 2 to simulate the stacking interface and weight of a stacked container. Steel plates and lead weights were used in test number 2 to simulate the stacked load.

TEST SITES: Testing was conducted at AFPEA, HQ AFLC/DSTZ, Building 70, Area C, Wright-Patterson AFB OH. The equipment required for testing was a forklift truck.

TEST PROCEDURES AND RESULTS

UN DROP TEST

Test No. 1: The CNU-447/E prototype container with the 675 pound test load was dropped from a height of 1.2 m as follows:

a. Flat drop on bottom.

b. Flat drop on top (see figure 4).

c. Flat drop on left side (long side).

d. Flat drop on forward end (short side).

e. Corner drop on right rear corner of cover (see figure

The container shall not spill its contents.

Results: The container was visually inspected following each drop:

a. Bottom - several welds securing the skid to the container base broke.

b. Top - middle three latches on the right side of the container became unlatched. These were secured before the testing continued.

c. Left side - no additional visible damage.

d. Forward end - cover deformed and weld cracked at forward right corner of the cover on the right edge. Crack was two inches long (see figure 6).

e. Right rear corner of cover - desiccant port fell off and cover deformed at corner impacted. Cover also deformed on aft end along the flange (see figure 7). Both latches on the aft end became unlatched.

Visual inspection of the inside of the container after testing revealed the missile was still in the cradle. The cradle had become detached from the base of the container (see figure 8). Detachment was caused by foam shear and not adhesive failure (see figure 9). The forward end of the cover was deformed where the missile nose had impacted and the dome shattered. A weld crack was visible on the forward edge of the cover on the inside. The desiccant basket was deformed and weld cracks were found at the aft end of the cover.

The container did not spill its contents. Results of this test are acceptable.

UN STACKING TEST

Test No. 2: At ambient temperature, the container was subjected to a superimposed load of 2230 pounds through the stacking provisions for 24 hours. The container shall not permanently deform.

Results: The container dimensions were checked and no permanent deformation occurred during the stacking test. The results of this test are acceptable.

CONCLUSION

1. The container successfully passed the POP tests, as prescribed by the UN test criteria.

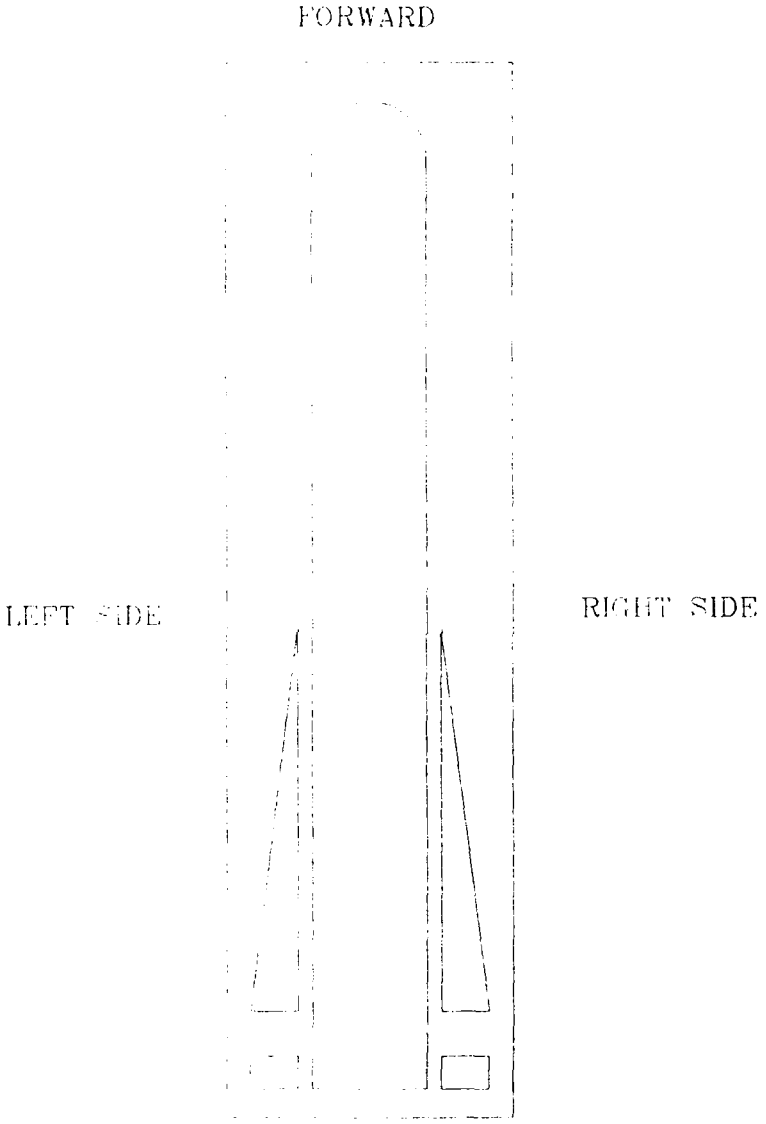
FORWARD
LEFT SIDE
RIGHT SIDE
AFT
Desiccant port
Humidity indicator
Pressure relief valve

FIGURE 1.

TABLE I. Container Test Plan.

AIR FORCE PACKAGING EVALUATION ACTIVITY
(Container Test Plan)

AFPEA PROJECT NUMBER: 87-P-130

CONTAINER SIZE (L x W x D)(INCHES) INTERIOR:	EXTERIOR:	WEIGHT (LBS) GROSS:	ITEM:	CUBE (CU. FT.)	QUANTITY	DATE
	108x28.5x30					7 Dec 88

ITEM NAME: AGM-65 Maverick Missile

MANUFACTURER:

CONTAINER NAME: CNU-445/E and CNU-447/E

CONTAINER COST:

PACK DESCRIPTION: Aluminum Container

CONDITIONING: Ambient

TEST NO.	REF STD/SPEC AND TEST METHOD OR PROCEDURE NO'S	TEST TITLE AND PARAMETERS	CONTAINER ORIENTATION	INSTRU-MENTATION
1.	UN DROP TEST UN "Orange Book", Requirement 9.7.3	Drop container from a height of 1.2 meters (3.94 feet), as required for Packing Group II. The container shall not spill its contents. A different container may be used for each drop.	One each flat drop on the bottom, top, long side, and short side; and a corner drop. Total of 5 drops. Test with heaviest All-up-round (AUR) missile.	Visual inspection
2.	UN STACKING TEST UN "Orange Book", Requirement 9.7.6	Simulate stacking to a minimum height of 3 m (9.84 ft) for 24 hours. There shall be no permanent deformation.	Test with heaviest AUR.	Visual inspection

COMMENTS:

PREPARED BY: Larry Nugent
Larry Nugent, Mechanical Engineer

APPROVED BY: Ted Hinds
TED HINDS, Chief, Design Br., AFPEA

AFALD FORM NOV 81 4

Figure 3. Missile attachment and test load.

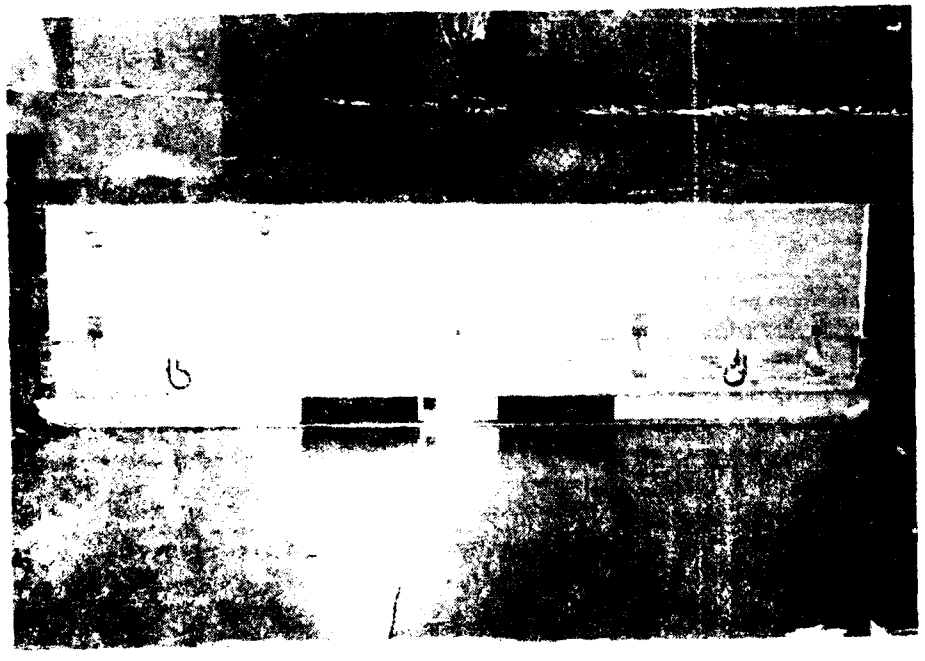

Figure 4. BNU-44 /E prototype container.

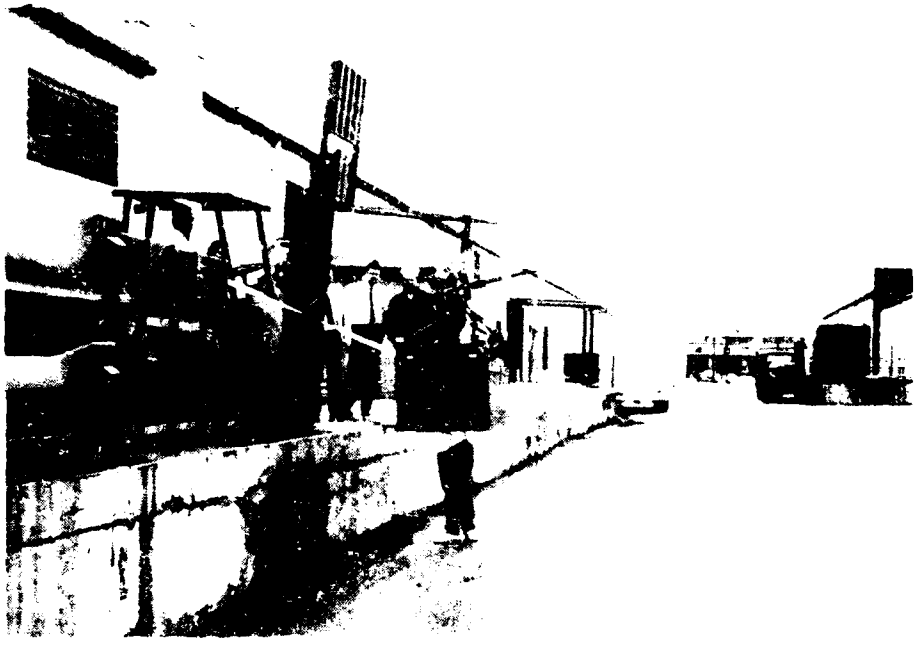

Figure 4. Flat drop on top surface.

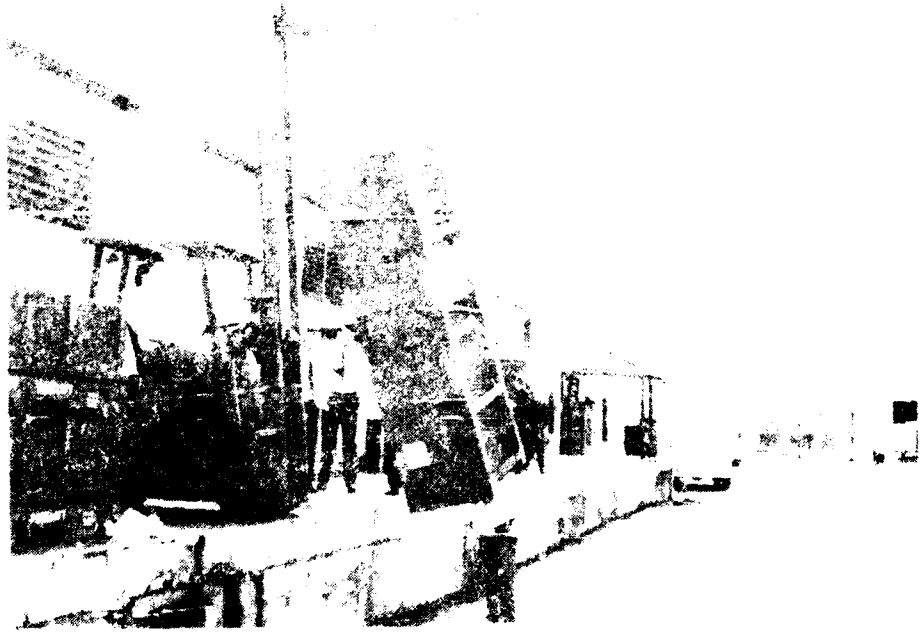

Figure 5. Corner drop on right rear corner of cover.

ri ice.

rop.

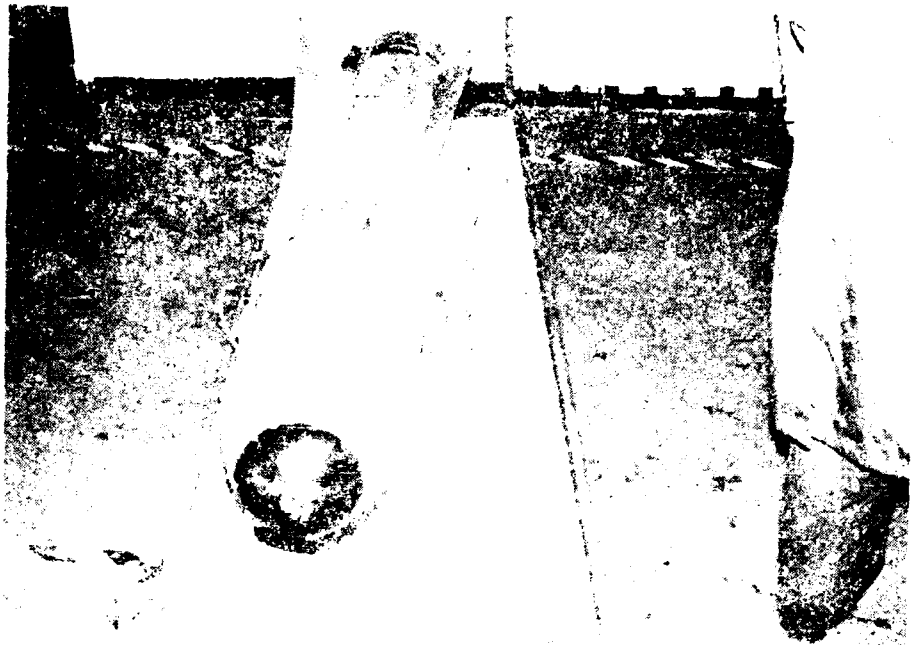

Figure 8. Interior damage after testing.

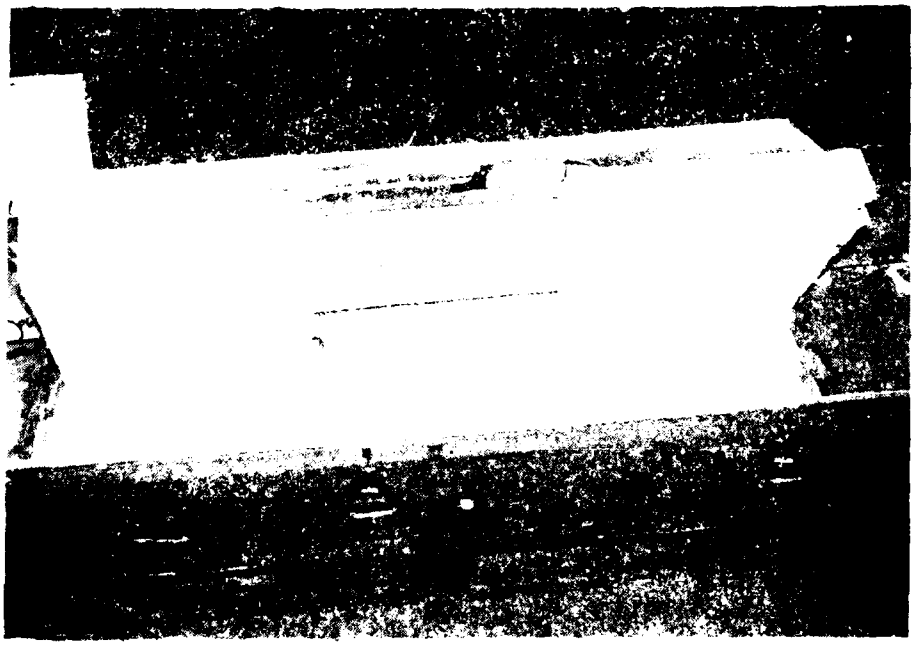

Figure 9. Foam failure in container base.

SECURITY CLASSIFICATION OF THIS PAGE

REPORT DOCUMENTATION PAGE

Form Approved
OMB No. 0704-0188

1a. REPORT SECURITY CLASSIFICATION UNCLASSIFIED	1b. RESTRICTIVE MARKINGS
2a. SECURITY CLASSIFICATION AUTHORITY NONE	3. DISTRIBUTION/AVAILABILITY OF REPORT Approved for Public Release Distribution Unlimited
2b. DECLASSIFICATION/DOWNGRADING SCHEDULE	
4. PERFORMING ORGANIZATION REPORT NUMBER(S) DST7 88-R-06	5. MONITORING ORGANIZATION REPORT NUMBER(S)
6a. NAME OF PERFORMING ORGANIZATION	6b. OFFICE SYMBOL (If applicable) / 7a. NAME OF MONITORING ORGANIZATION
6c. ADDRESS (City, State, and ZIP Code) HQ AFLC/DSTZ Wright-Patterson AFB OH 45433-5001	7b. ADDRESS (City, State, and ZIP Code)
8a. NAME OF FUNDING/SPONSORING ORGANIZATION	8b. OFFICE SYMBOL (If applicable) / 9. PROCUREMENT INSTRUMENT IDENTIFICATION NUMBER
8c. ADDRESS (City, State, and ZIP Code)	10. SOURCE OF FUNDING NUMBERS PROGRAM ELEMENT NO. / PROJECT NO. / TASK NO. / WORK UNIT ACCESSION NO.

11. TITLE (Include Security Classification)
Performance Oriented Packaging Testing of CNU-445/E and CNU-447/E Aluminum Maverick Missile Container

12. PERSONAL AUTHOR(S)
Larry R. Nugent

13a. TYPE OF REPORT	13b. TIME COVERED	14. DATE OF REPORT (Year, Month, Day)	15. PAGE COUNT
Final	FROM Feb 88 TO Nov 88	88-12	15

16. SUPPLEMENTARY NOTATION

17. COSATI CODES			18. SUBJECT TERMS (Continue on reverse if necessary and identify by block number)
FIELD	GROUP	SUB-GROUP	Missile Testing, Performance Oriented Packaging Testing, United Nations Testing, CNU-445/E, CNU-447/E

19. ABSTRACT (Continue on reverse if necessary and identify by block number)

Aeronautical Systems Division, ASD/TAML, requested assistance from the Air Force Packaging Evaluation Activity (AFPEA) to conduct certification and qualification testing on two new aluminum Maverick missile containers, the CNU-445/E and the CNU-447/E (see AFPEA Test Report 88-01). Part of the certification testing was the Performance Oriented Packaging (POP) testing on the container design.

(Continued)

20. DISTRIBUTION/AVAILABILITY OF ABSTRACT	21. ABSTRACT SECURITY CLASSIFICATION
UNCLASSIFIED/UNLIMITED SAME AS RPT. DTIC USERS	Unclassified
22a. NAME OF RESPONSIBLE INDIVIDUAL	22b. TELEPHONE (Include Area Code) / 22c. OFFICE SYMBOL
	(513) 257-3462 / HQ AFLC/DSTZD

DD Form 1473, JUN 86 (Previous editions are obsolete) SECURITY CLASSIFICATION OF THIS PAGE

Block 19 Continued:

The CNU-445/E and CNU-447/E containers were designed and fabricated by AD/YNP, Eglin AFB, FL 32542-5000. The containers are environmentally sealed with a humidity indicator, desiccant port, and a pressure relief valve. Both containers are designed to protect one AGM-65A/B/C/D/E/F/G all-up-round Maverick missile during world-wide shipment, storage, and handling. The containers will also be used for one missile without the guidance unit and for one missile without the guidance unit and the hydraulic actuation system. The CNU-447/E is the Navy version and differs from the CNU-445/E only in some external Navy-specific handling features.

The test plan used for the container was derived from United Nations (UN) Standard (Ref. ICAD 4.3), UN "Transport of Dangerous Goods", and DOD Hazardous Materials Packaging Test Plan.

Results of the tests conducted on one CNU-447/E container were acceptable. The containers did successfully pass the POP tests, as prescribed by the UN test criteria.

DISTRIBUTION LIST

DTIC FDAC Cameron Station Alexandria, VA 22304-6145	12
HQ AFLC/DSTZ Library Wright-Patterson AFB OH 45433-5999	20
HQ AFLC/DS Wright-Patterson AFB OH 45433-5999	2
HQ AFLC/DST Wright-Patterson AFB OH 45433-5999	2
HQ AFLC/DSTTP Wright-Patterson AFB OH 45433-5999	2
HQ USAF/LETT Washington DC 20330	1
HQ AFSC/LGT Andrews AFB MD 20334-5000	1
OC-ALC/DST Tinker AFB OK 73145	1
OO-ALC/DST Hill AFB UT 84406	2
SA-ALC/DST Kelly AFB TX 78241	1
SM-ALC/DST McClellan AFB CA 95652	1
WR-ALC/DST Robins AFB GA 31098	1
ASD/AWL Wright-Patterson AFB OH 45433	1
ASD/AILXP Wright-Patterson AFB OH 45433	2
AFSC AD/YBA Eglin AFB FL 32542	2
GSA, Office of Engineering Mgt Packaging Division Washington DC 20406	1

DISTRIBUTION LIST (Cont'd)

Commander 1
Naval Supply Systems Command
Attn: N. Karl (SUP 0611F)
Washington DC 20376-5000

Commander 1
Naval Air Systems Command
Attn: E. Panigot (AIR 41212A)
Washington DC 20361

Commander 1
Space and Naval Warfare Systems Command
Attn: T. Corbe (Code 8218)
Washington DC 20360

Commander 1
Naval Facilities Engineering Command
Hoffman Bldg. #2, Room 12S21
Attn: C. Manwarring (FAC 0644)
Alexandria, VA 22332

Commanding Officer 1
Naval Construction Battalion Center
Attn: K. Pollock (Code 15611K)
Port Hueneme, CA 93043

Commander 1
Naval Sea Systems Command
Attn: G. Mustin (SEA 66P)
Washington DC 20362

Commander 1
Naval Sea Systems Command
Attn: F. Basford (SEA 05M3)
Washington DC 20362

Commanding Officer 1
Naval Aviation Supply Office
700 Robbins Avenue
Attn: J. Yannello (Code EPP-A)
Philadelphia, PA 19111-5098

Commanding Officer 1
Navy Ships Parts Control Center
P.O. Box 2020
Attn: F. Sechrist (Code 0541)
Mechanicsburg, PA 17055-0788

DISTRIBUTION LIST (Cont'd)

Commanding Officer Naval Air Engineering Center Attn: F. Magnifico (SESD Code 9321) Lakehurst, NJ 08733-5100	1
Commanding Officer Naval Weapons Station Earle NWHC/Code 8023 Colts Neck,NJ 07722-5000	2
Commander Pacific Missile Test Center Attn: Philip Poole (Code 2051) Point Mugu, CA 93042	1
ASO/TEP-A 4030 700 Robbins Ave Philadelphia, PA 19111	1
US AMC Packaging, Storage, and Containerization Center/SDSTO-T Tobyhanna, PA 18466-5097	1
DLSIE/AMXMC-D US Army Logistics Mgt Ctr Ft Lee VA 23801-6034	1
US Army AMCCOM/SMCAR-AED Dover, NJ 07801-5001	1
US Army Natick Labs/STRNC-ES Natick MA 01760	1
HQ DLA/OWP Cameron Station Alexandria, VA 22304-6100	1
HQ AFLC/MMA Wright-Patterson AFB OH 45433	2
ALD/CV Wright-Patterson AFB OH 45433	2
ALD/OA Wright-Patterson AFB OH 45433	2
ALD LOC/CV Wright-Patterson AFB OH 45433	2

DISTRIBUTION LIST (Cont'd)

AFLC LOC/TL Wright-Patterson AFB OH 45433	2
ASD/SDM Wright-Patterson AFB OH 45433	2
AFSC AD/YBEC Eglin AFB FL 32542	2
HQ TAC/LGWL Langley AFB, VA 23665	2
OO-ALC/DSTD Hill AFB, UT 84056	2
OO-ALC/MMWMM Hill AFB, UT 84056-5609	2